TITLE OF THE INVENTION
                METHOD AND NODE APPARATUS FOR FILTERING
ICMP DATA FRAME

5   BACKGROUND OF THE INVENTION
                1. Field of the Invention
                The present invention relates to a method
and a node apparatus for filtering an ICMP (Internet
Control Message Protocol) data frame. More
10   particularly, the present invention relates to a
method and a node apparatus for filtering an ICMP
data frame in a network system having functions to
transmit and receive the ICMP data frame.
                2. Description of the Related Art
15   An ICMP is known as a protocol utilized
for notifying of an error and other relevant
information during data transmission on Internet
layers through networks using a TCP/IP (Transmission
Control protocol/Internet Protocol).
20   FIG. 1 is a diagram showing a process to
generate an ICMP data frame. In a case of
transmitting an IP data frame from a node apparatus
Y through a node apparatus A to a node apparatus Z,
the node apparatus A receives the IP data frame from
25   the node apparatus Y, recognizes a destination
address stored in the IP data frame, and attempts to
transmits the IP data frame to the node apparatus Z.
However, the IP data frame cannot be transmitted to
the node apparatus Z, since the node apparatuses A
30   and Z are not connected to each other, as shown in
FIG. 1. Subsequently, the node apparatus A detects
such a transmission failure, generates an ICMP data
frame to notify the node apparatus Y that the IP
data frame received from the node apparatus Y cannot
35   be transmitted to the node apparatus Z, and returns
the ICMP data frame to the node apparatus Y.
                For each data frame transmitted from a

node apparatus, an ICMP data frame is returned to the node apparatus if the data frame cannot reach its destination. Accordingly, in a case in which a large number of data frames are unable to reach

5 their destinations, the same number of ICMP data frames are returned to their source node apparatuses, and thus congestion of processes at a communication node or congestion of communication lines may occur, thereby causing a failure of transmission to other

10 proper data frames. Especially, transmission of ICMP data frames can be used by hackers and crackers who maliciously cause network failures as a means to generate the congestion of processes at the communication node and the congestion of

15 communication lines.

Japanese Laid-Open Patent Application No. 7-210473 discloses a method of using transmission paths as resources efficiently, and of expanding a function to control congestion, by evaluating an

20 attribute of data to be transmitted in addition to a type of a transmission path which the data is transmitted through, a destination address of the data, and a network protocol type of the data, by classifying the data based on the evaluation of the

25 data, and then, by determining whether transmission of the data is necessary, and executing a data filtering control to determine a transmission rate of the data, based on the classification. The disclosed method is applied to a node receiving data

30 from other nodes as an object of the data filtering control. Thus, a cause of congestion of such as networks is not considered in the disclosed method, the cause including generation of an ICMP data frame having a new protocol attribute at a node apparatus,

35 and transmission of the ICMP data frame to a source node apparatus of a data frame, in a case in which the data frame cannot be transmitted to its

destination for some reason, or in a case in which a
problem is found in a datagram. Consequently,
receiving a large number of IP data frames at a node
apparatus, and transmitting the large number of ICMP
5   data frames from the node apparatus back to source
node apparatuses of the data frames cause an
increase in network traffic and congestion of
networks.

10   SUMMARY OF THE INVENTION
         Accordingly, it is a general object of the
present invention to provide a method and a node
apparatus for filtering an ICMP (Internet Control
Message Protocol) data frame. A more particular
15   object of the present invention is to provide a
method and a node apparatus for filtering an ICMP
data frame that is to be generated and transmitted
by the node apparatus, thereby preventing an
increase in network traffic and congestion of
20   networks.
         The above-described object of the present
invention is achieved by a method of transmitting an
ICMP (Internet Control Message Protocol) data frame
to a transmission source in response to an IP
25   (Internet Protocol) data frame received from the
transmission source when detecting failure regarding
the IP data frame, the method including the steps of
storing information about necessity of generating
the ICMP data frame for each attribute of the ICMP
30   data frame corresponding to a type of the failure,
determining the necessity of generating the ICMP
data frame by referring to the information when
detecting the failure, generating the ICMP data
frame if it is determined that generation of the
35   ICMP data frame is necessary, and transmitting the
ICMP data frame to the transmission source if the
ICMP data frame is generated.

By restraining the generation of the ICMP data frame, based on the necessity of generating the ICMP data frame, a node apparatus can prevent an increase in the number of ICMP data frames transmitted to the transmission source of the IP data frame, thereby preventing an increase in network traffic and congestion of networks.

Other objects, features and advantages of the present invention will become more apparent from the following detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagram showing a process to generate an ICMP data frame;

FIG. 2 is a block diagram showing a configuration of a node apparatus according to a first embodiment of the present invention;

FIG. 3 is a flowchart showing a process executed by an ICMP processing unit of the node apparatus according to the first embodiment;

FIG. 4 is a flowchart showing a process executed by an ICMP information management unit of the node apparatus according to the first embodiment;

FIG. 5 is a flowchart showing a process executed by a system-condition management unit of the node apparatus according to the first embodiment;

FIG. 6 is a flowchart showing a process executed by a line-condition management unit of the node apparatus according to the first embodiment;

FIG. 7 is a flowchart showing a process executed by an ICMP filtering unit of the node apparatus according to the first embodiment;

FIG. 8 is a flowchart showing another process executed by the ICMP information management

unit of the node apparatus according to the first embodiment;

FIG. 9 is a diagram showing a format of the ICMP data frame;

5   FIG. 10 is a diagram showing an ICMP information management database of the node apparatus according to the first embodiment;

FIG. 11 is a first diagram showing a method of generating the ICMP data frame, according 10 to a second embodiment of the present invention;

FIG. 12 is a second diagram showing the method of generating the ICMP data frame, according to the second embodiment; and

FIG. 13 is a diagram showing the method of 15 generating the ICMP data frame in a case in which a system failure occurs.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

A description will now be given of 20 preferred embodiments of the present invention, with reference to the accompanying drawings.

FIG. 2 is a block diagram showing a configuration of a node apparatus according to a first embodiment of the present invention. FIG. 2 25 shows only a configuration of a node apparatus A. However, configurations of the other nodes Y and Z are the same as that of the node apparatus A. The node apparatus A shown in FIG. 2 includes a reception unit 1, a transmission unit 2, an ICMP 30 information management unit 3, an ICMP filtering unit 4, an ICMP processing unit 5, a system-condition management unit 6, a line-condition management unit 7, an ICMP information management database 11, a system-condition database 12 and a 35 line-condition database 13.

At the node apparatus A, the reception unit 1 receives data frames including an ICMP data

frame transmitted by other node apparatuses connected to the node apparatus A. The transmission unit 2 transmits data frames including an ICMP data frame to other node apparatuses connected to the
5 node apparatus A. The ICMP information management unit 3 manages information about necessity of data-frame transmission and a transmission rate of ICMP data frames for each attribute of the ICMP data frame including a type and a code of the ICMP data
10 frame, corresponding to a type of a failure, by using the ICMP information management database 11.

The ICMP processing unit 5 generates an ICMP data frame corresponding to the information managed by the ICMP information management unit 3.
15 To be concrete, the ICMP processing unit 5 decides to generate an ICMP data frame at a fixed rate or not to generate the ICMP data frame, based on the attribute of the ICMP data frame. Additionally, the ICMP processing unit 5 requests the ICMP filtering
20 unit 4 to transmit the generated ICMP data frame. The ICMP filtering unit 4 executes filtering on the ICMP data frame requested by the ICMP processing unit 5 to be transmitted, based on the information managed by the ICMP information management unit 3,
25 the information including the necessity of the data-frame transmission and the transmission rate of the ICMP data frame. In other words, the ICMP filtering unit 4 filters the ICMP data frame by deciding to transmit the ICMP data frame at a fixed rate or not
30 to transmit the ICMP data frame, based on the attribute of the ICMP data frame. Accordingly, the above-described decision on generation and transmission of an ICMP data frame based on an attribute of the ICMP data frame prevents the node
35 apparatus A from outputting a large number of ICMP data frames, thereby improving processing performance of the node apparatus A, achieving

efficient networks, and preventing congestion of the networks.

The system-condition management unit 6 utilizes an existing technology to manage a
5   condition of the node apparatus A, by using the system-condition database 12. Similarly, the line-condition management unit 7 utilizes an existing technology to manage conditions of lines connected to the node apparatus A, by using the line-condition
10   database 13. The ICMP processing unit 5 and the ICMP filtering unit 4 adjust respectively generation and transmission of the ICMP data frame, based not only on the information about the necessity of the data frame transmission and the transmission rate of
15   the ICMP data frame, but also on information about a condition of the node apparatus A managed by the system-condition management unit 6 and a line condition of a destination of the ICMP data frame managed by the line-condition management unit 7. In
20   other words, the ICMP processing unit 5 decides to generate the ICMP data frame or not to generate the ICMP data frame, based on the condition of the node apparatus A and of lines, in addition to the attribute of the ICMP data frame. Similarly, the
25   ICMP filtering unit 4 decides to transmit the ICMP data frame or not to transmit the ICMP data frame, based on the condition of the node apparatus A and of the lines, in addition to the attribute of the ICMP data frame. Accordingly, the above-described
30   decision on generation and transmission of an ICMP data frame based not only on an attribute of the ICMP data frame, but also on a condition of the node apparatus A and conditions of the lines, enables efficient filtering on the ICMP data frame, thereby
35   preventing the node apparatus A from outputting a large number of ICMP data frames, thereby improving processing performance of the node apparatus A,

achieving efficient networks, and preventing
congestion of the networks.

FIG. 3 is a flowchart showing a process
executed by the ICMP processing unit 5 of the node

5   apparatus A according to the first embodiment. The
following steps are performed by the ICMP processing
unit 5 after receiving a request for generation of
an ICMP data frame from the reception unit 1, at a
step S1. The ICMP processing unit 5 asks the ICMP

10   information management unit 3 about necessity of
generating an ICMP data frame at a step S2, asks the
system-condition management unit 6 about a system
condition of the node apparatus A at a step S3, and
asks the line-condition management unit 7 about a

15   line condition at a step S4. Subsequently, the ICMP
processing unit 5 determines whether the generation
of the ICMP data frame is necessary, at a step S5.
If not, the ICMP processing unit 5 executes no more
steps. If it is determined at the step S5 that the

20   generation of the ICMP data frame is necessary, the
ICMP processing unit 5 proceeds to a step S6, and
generates the ICMP data frame. At a step S7, the
ICMP processing unit 5 requests the ICMP filtering
unit 4 to filter the generated ICMP data frame. At

25   a step S8, the ICMP processing unit 5 determines
whether the ICMP data frame can be transmitted. If
the ICMP data frame cannot be transmitted, the ICMP
processing unit 5 executes no more steps for
transmitting the ICMP data frame. If it is

30   determined at the step S8 that the ICMP data frame
cane be transmitted, the ICMP processing unit 5
requests the transmission unit 2 to transmit the
ICMP data frame from the node apparatus A, at a step
S9. In response to the request from the ICMP

35   processing unit 5, the transmission unit 2 transmits
the ICMP data frame from the node apparatus A.

FIG. 4 is a flowchart showing a process

executed by the ICMP information management unit 3
in response to the inquiry from the ICMP processing
unit 5 at the step S2 shown in FIG. 3. After
receiving the inquiry from the ICMP processing unit

5   5, the ICMP information management unit 3 searches
through the ICMP information management database 11
by use of an attribute of an ICMP data frame
corresponding to a type of failure, the attribute
including a type and a code of the ICMP data frame,

10 at a step S11. As a result, the ICMP information
management unit 3 obtains information about
necessity of generating the ICMP data frame, at a
step S12. Subsequently, the ICMP information
management unit 3 notifies the ICMP processing unit

15 5 of the information about the necessity of
generating the ICMP data frame, at a step S13.
        FIG. 5 is a flowchart showing a process
executed by the system-condition management unit 6
in response to the inquiry from the ICMP processing

20 unit 5 at the step S3 shown in FIG. 3. After
receiving the inquiry from the ICMP processing unit
5, the system-condition management unit 6 searches
through the system-condition database 12, at a step
S21. As a result, the system-condition management

25 unit 6 obtains information about a system condition
of the node apparatus A, at a step S22.
Subsequently, the system-condition management unit 6
notifies the ICMP processing unit 5 of the
information about the system condition of the node

30 apparatus A, at a step S33.
        FIG. 6 is a flowchart showing a process
executed by the line-condition management unit 7 in
response to the inquiry from the ICMP processing
unit 5 at the step S4 shown in FIG. 3. After

35 receiving the inquiry from the ICMP processing unit
5, the line-condition management unit 7 searches
through the line-condition database 13, at a step

S31. As a result, the line-condition management
unit 7 obtains information about a condition of a
line connected to a destination of the ICMP data
frame, at a step S32. Subsequently, the line-
5 condition management unit 7 notifies the ICMP
processing unit 5 of the information about the
condition of the line connected to the destination
of the ICMP data frame, at a step S33.

FIG. 7 is a flowchart showing a process
10 executed by the ICMP filtering unit 4 in response to
the inquiry from the ICMP processing unit 5 at the
step S7 shown in FIG. 3. After receiving the
request from the ICMP processing unit 5 to filter
the ICMP data frame at a step S41, the ICMP
15 filtering unit 4 executes the following steps. The
ICMP filtering unit 4 asks the ICMP information
management unit 3 about necessity of transmitting
the ICMP data frame at a step S42, asks the system-
condition management unit 6 about the system
20 condition of the node apparatus A at a step S43, and
asks the line-condition management unit 7 about the
line condition at a step S44. The ICMP information
management unit 3 executes a later-described process
shown in FIG. 8, in response to the step S42. The
25 system-condition management unit 6 executes the
process shown in FIG. 5, and returns a result to the
ICMP filtering unit 4 in response to the step S43.
Additionally, the line-condition management unit 7
executes the process shown in FIG. 6, and returns a
30 result to the ICMP filtering unit 4 in response to
the step S44. Subsequently, the ICMP filtering unit
4 determines whether the transmission of the ICMP
data frame is necessary, at a step S45. If not, the
ICMP filtering unit 4 proceeds to a step S47. If it
35 is determined at the step S45 that the transmission
of the ICMP data frame is necessary, the ICMP
filtering unit 4 proceeds to a step S46, and

determines the number of data possible to be transmitted in a unit time for each ICMP data frame that can be transmitted, based on a transmission rate directed by the ICMP information management

5　unit 3, the transmission rate being a rate of ICMP data frames to be transmitted among a plurality of ICMP data frames generated corresponding to data frames received in a unit time, for instance, one second. Subsequently, the ICMP filtering unit 4

10　notifies the ICMP processing unit 5 of a result of filtering the ICMP data frame, in other words, information about whether the ICMP data frame can be transmitted, at the step S47.

　　　　FIG. 8 is a flowchart showing a process

15　executed by the ICMP information management unit 3 in response to the inquiry from the ICMP filtering unit 4 at the step S42 shown in FIG. 7. After receiving the inquiry from the ICMP filtering unit 4, the ICMP information management unit 3 searches

20　through the ICMP information management database 11 by use of the attribute of the ICMP data frame including the type and the code of the ICMP data frame, at a step S51. As a result, the ICMP information management unit 3 obtains information

25　about necessity of transmitting the ICMP data frame and a transmission rate of the ICMP data frame, at a step S52. Subsequently, the ICMP information management unit 3 notifies the ICMP filtering unit 4 of the information about the necessity of

30　transmitting the ICMP data frame and the transmission rate of the ICMP data frame, at a step S53.

　　　　FIG. 9 is a diagram showing a format of an ICMP data frame. The ICMP data frame includes an IP

35　header and an ICMP message. A first 26 bytes of the ICMP data frame is the IP header including areas for setting a version, a header length, a type of

service (TOS), a packet length, an identification, a flag, a fragment offset, a time to live (TTL), a protocol (a protocol type), a header checksum, a source IP address, a destination IP address, an

5   option and a padding. The ICMP message includes areas for setting an ICMP type, a code, a checksum and ICMP data. A data length of the ICMP data is variable depending on a message type.

FIG. 10 is a diagram showing an ICMP

10   information management database 11. The ICMP information management database 11 registers information about each of necessity of generation, necessity of transmission and a transmission rate of an ICMP data frame, corresponding to a type and a

15   code of the ICMP data frame. It should be noted that contents of the type and the code are provided on right sides of a type field and a code field of the ICMP information management database 11 respectively.

20   A description will now be given of generation and filtering of an ICMP data frame in a case in which the node apparatus A receives IP data frames "a", "b" and "c" transmitted from the node apparatus Y though the node apparatus A to the node

25   apparatus z, each IP data frame having a possibility of causing generation of an ICMP data frame at the node apparatus A. FIGS. 11 and 12 are diagrams showing a method of generating an ICMP data frame, according to a second embodiment of the present

30   invention.

The node apparatus Y outputs six IP data frames "a" causing generation of an ICMP data frame whose type and code are respectively "03" and "01", four IP data frames "b" causing generation of an

35   ICMP data frame whose type and code are respectively "05" and "01", and two IP data frames "c" causing generation of an ICMP data frame whose type is "04"

in one second, as shown in FIG. 11. The ICMP data frame whose type and code are respectively "03" and "01" indicates that the IP data frame "a" cannot reach the node apparatus Z as a destination, since

5   the IP data frame "a" cannot reach a host, based on the ICMP information management database 11. Similarly, the ICMP data frame whose type and code are respectively "05" and "01" indicates that a host route for transmitting the IP data frame "b" to the

10 node apparatus Z is changed. Additionally, the ICMP data frame whose type is "04" indicates that transmission of the IP data frame "c" is restrained.

The node apparatus A receives the IP data frames transmitted from the node apparatus Y by use

15 of the reception unit 1. Subsequently, the node apparatus A attempts to transmit the IP data frames to the node apparatus Z. However, the node apparatus A detects transmission failure at the reception unit 1, since the node apparatuses A and Z

20 are not connected to each other. The reception unit 1 requests the ICMP processing unit 5 to generate ICMP data frames since the transmission of all the IP data frames received from the node apparatus Y is failed. The ICMP processing unit 5 notifies the

25 ICMP information management unit 3 of causes of the transmission failure of the IP data frames "a", "b" and "c". The ICMP information management unit 3 determines that ICMP data frames corresponding to the IP data frames "a" and "b" are necessary to be

30 generated, and that ICMP data frames corresponding to the IP data frames "c" is not necessary to be generated, by comparing the type "03" and the code "01" of the IP data frame "a", the type "05" and the code "01" of the IP data frame "b", and the type

35 "04" of the IP data frame "c" with information stored in the ICMP information management database 11 shown in FIG. 10. Subsequently, the ICMP

-14-

information management unit 3 notifies the ICMP
processing unit 5 of the necessity of generating the
ICMP data frames corresponding to the IP data frames
"a", "b" and "c" in response to the request from the
5   ICMP processing unit 5. After receiving the
notification from the ICMP information management
unit 3, the ICMP processing unit 5 generates ICMP
data frames "a" corresponding to the IP data frames
"a", and ICMP data frames "b" corresponding to the
10   IP data frames "b", by following the format of an
ICMP data frame shown in FIG. 9. It should be noted
that the ICMP data frame "a" indicates that the IP
data frame "a" cannot reach its destination, and
that the ICMP data frame "b" indicates that a route
15   of transmitting the IP data frame "b" is changed.
        Additionally, the ICMP processing unit 5
requests the ICMP filleting unit 4 to determine
whether the ICMP data frames "a" and "b" are
necessary to be filtered. The ICMP filtering unit 4
20   asks the ICMP information management unit 3 about a
result of filtering related to the ICMP data frames
"a" and "b", after receiving the request from the
ICMP processing unit 5. Subsequently, the ICMP
information management unit 3 obtains information
25   about the necessity of transmitting the ICMP data
frames "a" and "b" from the ICMP information
management database 11. The ICMP information
management unit 3 also obtains filtering information
indicating that transmission of the ICMP data frames
30   "a" is necessary, and that a transmission rate of
the ICMP data frames "a" is 50%. Additionally, the
ICMP information management unit 3 obtains filtering
information indicating that transmission of the ICMP
data frames "b" is necessary, and that a
35   transmission rate of the ICMP data frames "b" is 30%.
The information management unit 3 notifies the ICMP
filtering unit 4 of the above-described filtering

information about the ICMP data frames "a" and "b"
after obtaining the filtering information.

The ICMP filtering unit 4 decreases the
number of the ICMP data frames "a" possible to be
5   transmitted from six frames per second to three
frames per second by referring to its transmission
rate 50%, corresponding to the six IP data frames
"a" received from the node apparatus Y in one second,
based on the filtering information notified by the
10   ICMP information management unit 3. Additionally,
the ICMP filtering unit 4 decreases the number of
the ICMP data frames "b" possible to be transmitted
from four frames per second to one frame per second
by referring to its transmission rate 30%,
15   corresponding to the four IP data frames "b"
received from the node apparatus Y in one second.
Then, the ICMP filtering unit 4 notifies the ICMP
processing unit 5 that transmission of three ICMP
data frames "a" and one ICMP data frame "b" are
20   required to be transmitted.

The ICMP processing unit 5 requests the
transmission unit 2 to transmit the three ICMP data
frames "a" and the one ICMP data frames "b" that are
required to be transmitted from the node apparatus A
25   to the node apparatus Y. The transmission unit 2
filters only four ICMP data frames including the
three ICMP data frames "a" and the one ICMP data
frame "b", and transmits the four ICMP data frames
to the node apparatus Y, instead of a conventional
30   method of transmitting twelve ICMP data frames to
the node apparatus Y. As described above,
transmission of ICMP data frames is restrained, and
thus congestion of networks can be prevented.
Additionally, processing performance of the node
35   apparatus A can be increased. Furthermore, data
frames that cannot be transmitted or received by a
conventional node apparatus because of load on the

networks and congestion of the networks can now be
transmitted or received efficiently by a node
apparatus according to the present invention.

A description will now be given of a
method of filtering ICMP data frames based on a
system condition of a node apparatus and a condition
of a line to a destination, when generating and
transmitting the ICMP data frames in a case of
detecting failure in transmission of corresponding
IP data frames received from another node apparatus.
The node apparatus Y shown in FIG. 11 transmits six
IP data frames "a" causing generation of the ICMP
data frame "a" whose type and code are respectively
"03" and "01", four IP data frames "b" causing
generation of the ICMP data frame "b" whose type and
code are respectively "05" and "01", and two IP data
frames "c" causing generation of the ICMP data frame
"c" whose type is "04" in one second. The ICMP data
frame "a" indicates that the IP data frame "a"
cannot reach the node apparatus Z as a destination,
based on the ICMP information management database 11.
Similarly, the ICMP data frame "b" indicates that a
route for transmitting the IP data frame "b" to the
node apparatus Z is changed. Additionally, the ICMP
data frame "c" indicates that transmission of the IP
data frame "c" is restrained.

The node apparatus A receives the IP data
frames transmitted from the node apparatus Y by use
of the reception unit 1. Subsequently, the node
apparatus A attempts to transmit the IP data frames
to the node apparatus Z. However, the node
apparatus A detects transmission failure at the
reception unit 1, since the node apparatuses A and Z
are not connected to each other. The reception unit
1 requests the ICMP processing unit 5 to generate
ICMP data frames since the transmission of all the
IP data frames received from the node apparatus Y is

failed. The ICMP processing unit 5 asks the system-condition management unit 6 about a system condition of the node apparatus A. It is assumed that the system condition of the node apparatus A is a failed

5   condition. The system-condition management unit 6 recognizes that the system condition of the node apparatus A is the failed condition, by referring to the system-condition database 12, and notifies the ICMP processing unit 5 of the failed condition. The

10   ICMP processing unit 5 does not generate the ICMP data frames "a", "b" and "c" corresponding to the IP data frames "a", "b" and "c" respectively. On the other hand, if having generated the ICMP data frames, the ICMP processing unit 5 asks the ICMP filtering

15   unit 4 about the necessity of filtering the ICMP data frames. If the system condition of the node apparatus A is the failed condition, the ICMP filtering unit 4 requests the system-condition management unit 6 to obtain information about the

20   failed condition of the node apparatus A. In response to the request from the ICMP filtering unit 4, the system-condition management unit 6 obtains the information about the failed condition by referring to the system-condition database 12, and

25   notifies the ICMP filtering unit 4 of the information about the failed condition. The ICMP filtering unit 4 having recognized the failed condition of the node apparatus A notifies the ICMP processing unit 5 that all the ICMP data frames "a"

30   and "b" cannot be transmitted from the node apparatus A. The transmission unit 2 of the node apparatus A does not transmit the ICMP data frames to the node apparatus Y, as shown in FIG. 13, since the ICMP processing unit 5 does not request the

35   transmission unit 2 to transmit the ICMP data frames.
        Additionally, the ICMP filtering unit 4 makes the system-condition database 12 including

information about system conditions and the line-condition database 13 including information about line conditions further include information about the necessity of transmitting the ICMP data frames

5 and the transmission rate of the ICMP data frames, similarly to the ICMP information management database 11, thereby enabling filtering of the ICMP data frames.

Accordingly, by restraining generation and

10 transmission of ICMP data frames, based on a system condition of a node apparatus or a condition of a line connecting the node apparatus and a destination of IP data frames, the node apparatus can avoid an increase in the number of the ICMP data frames

15 transmitted to a transmission source of the IP data frames, thereby achieving improvement of processing performance of the node apparatus, an increase in efficiency of networks, and prevention of congestion of the networks. Additionally, a node apparatus

20 according to the present invention can efficiently transmit or receive data frames that are unable to be transmitted or received by a conventional node apparatus because of load on the networks and congestion of the networks.

25 The above description is provided in order to enable any person skilled in the art to make and use the invention and sets forth the best mode contemplated by the inventors of carrying out the invention.

30 The present invention is not limited to the specially disclosed embodiments and variations, and modifications may be made without departing from the scope and spirit of the invention.

The present application is based on

35 Japanese Priority Application No. 2000-208855, filed on July 10, 2000, the entire contents of which are hereby incorporated by reference.